Diamond plates create nanostructures through pressure, not chemistry

By Neal Singer

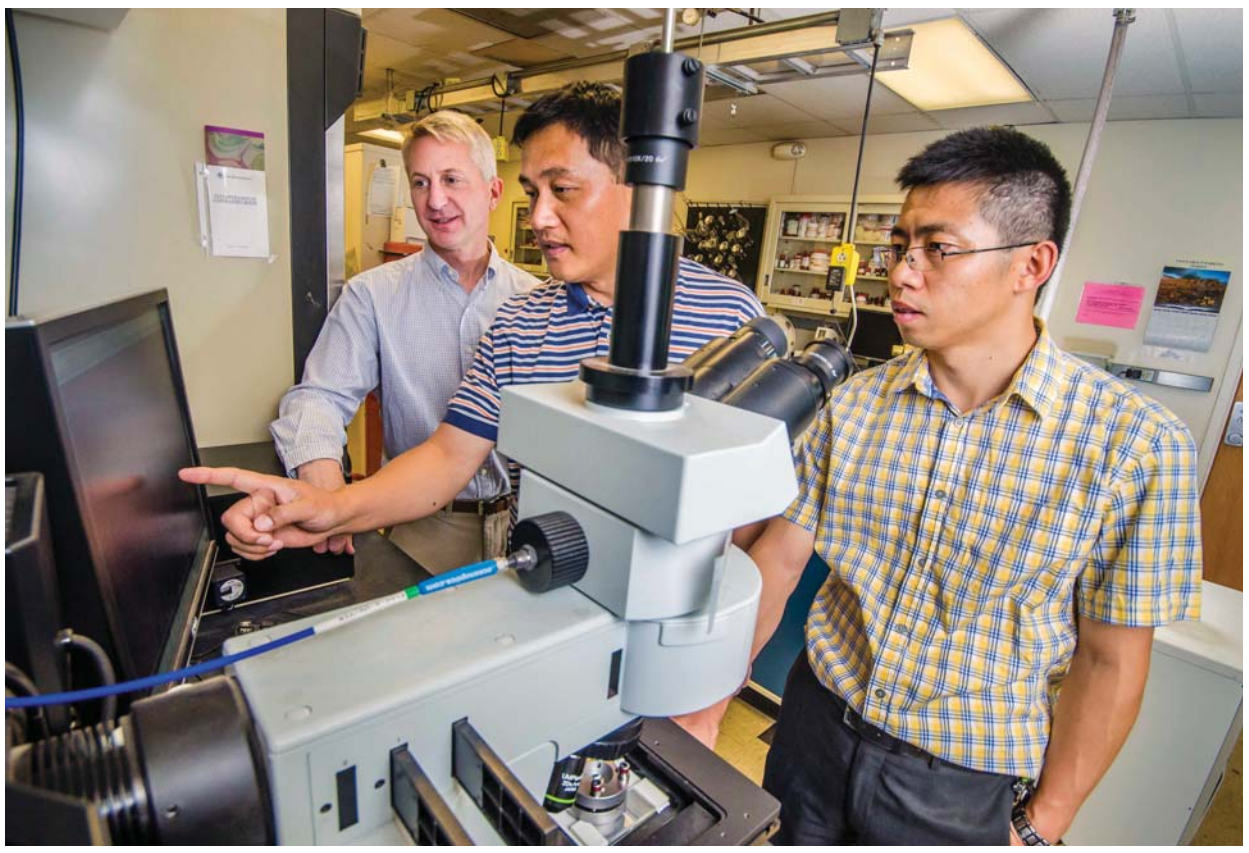
You wouldn't think that mechanical force — the simple kind used to eject unruly patrons from bars, shoe a horse, or emboss the raised numerals on credit cards — could process nanoparticles more subtly than the most advanced chemistry.

Yet, in a paper published June 24 in *Nature Communications*, Hongyou Fan (1815) and colleagues appear to have achieved a start toward that end.

Their newly patented and original method uses simple pressure — a kind of high-tech embossing — to produce finer and cleaner results in forming silver nanostructures than do chemical methods, which are not only inflexible in their results but leave harmful byproducts to dispose of.

Hongyou calls his approach "a simple stress-based

(Continued on page 4)



SANDIA RESEARCHER HONGYOU FAN (1815), center, points out a nanoparticle result to Sandia paper co-authors Paul Clem (1816), left, and Binsong Li (1815). (Photo by Randy Montoya)

¡Goooooaaaallll!

Just in time to tap into the groundswell of interest in the US about soccer and the 2014 World Cup, retired Sandian John Taylor has written a book explaining the science of the game. "Soccer is more than just a fascinating mobile chess match," John writes. "It is also an endless scientific panorama." Story on **page 5.**

Sandia LabNews

Vol. 66, No. 14 July 11, 2014

Managed by Sandia Corporation for the National Nuclear Security Administration

Sandia National Laboratories

Engineered Safety

Repackaging waste drums: Understanding the technical basis

By Sue Major Holmes

Removing prohibited items from five waste drums from an outside institution meant three weeks of work for Sandia's Non-Reactor Nuclear Facilities Org. 1387, but eight months of planning, facility modifications, and reviews.

Eight of 30 containers from the outside organization didn't meet the criteria for disposal. Five drums needed glovebox handling and two of those were hazard category 3. That kind of repackaging had to be done at the Labs' Radioactive and Mixed Waste Management Facility (RMWMF) — but it wasn't approved for the higher hazard category.

RMWMF went through a formal DOE process to get a temporary exemption to repackage the waste. Sandia made modifications to a glovebox, adding a special HEPA filter, fire suppression, and puncture-resistent gloves. "The gloveboxes added the engineering controls above what [Tech] Area 5 could provide," says manager Jeff Jarry (4144).

UNDERSTANDING TECHNICAL BASIS — Chris Eckstein (4144) works in a glovebox while processing radioactive waste. The precepts of Sandia's Engineered Safety call for understanding the technical basis for work being done. (Photo courtesy of Org. 4144)

Readiness review

The facility also performed a readiness review, including mockups with clean material to demonstrate the process step by step, and gave a tour and briefing on the planned work to the Defense Nuclear Facilities Safety Board.

The project was a success: The material is now buried at the Waste Isolation Pilot Plant near Carlsbad.

During repackaging, Sandia's team even removed some valuable radioactive material so it could be used.

"If you can't control a hazard, you have to mitigate the hazard," says Mike Spoerner (1387), who was project lead at the time under Jeff. "You want to provide Engineered Safety to mitigate those risks. We know that all of them can't be engineered, so there are also administrative controls you can put in."

Although the 2011 project occurred before Sandia's formal adoption of Engineered Safety, Jeff says it had an Engineered Safety flavor in understanding the technical basis for the work, and followed a robust Work Planning and Control process.

"Risk analysis is what you're doing. You identify all your risk points," Mike says.

Family Day website goes live next week

THE FAMILY DAY 2014 WEBSITE is scheduled to be live on July 14. Reach it at familyday.sandia.gov. Although additional information will be added as the Sept. 20 event approaches, registration will be possible. And remember, there are strict deadlines for getting that done. This site also will include an expanded Frequently Asked Questions tab.

LAB NEWS photographer Randy Montoya captures memorable images of Indepedence Day. See his photos on **page 8.**

That's that

I wanted to pass along something that happened to me this morning that may have some value as a cautionary safety story.

Let me see if I can describe the scene in a way you'll be able to visualize it. I was driving to work on Eubank just south of Central Ave. As sometimes happens at 7:30 a.m., the traffic was backed up from the Eubank Gate almost to Central. Since I work in IPOC building, I decided to make a left on Southern, go around the corner and approach IPOC from the back way. I got in the turn lane and was moving along toward the traffic light at a reasonable 25 mph or so.

Here's where it gets dicey: As a courtesy, drivers in the two backed-up lanes — that is, the lanes to my right — stopped to create an opening for a vehicle trying to cross Eubank from a side street just north of Southern. The driver of that vehicle thought he had a clear shot, not being able to see me in that far lane. Bottom line: He pulled right in front of me. I hit the brakes but there was no way I was going to be able to stop. Our eyes locked, that driver's and mine, and we both knew the inevitable was going to happen. The wreck played out in slow motion; I T-boned the big van, crumpling the front end of my car. The van was hardly damaged and was probably back in service before the day was out. I haven't heard from my insurance company, but I'm virtually positive my beloved Isuzu Trooper is totaled.

Anyhow, here's the safety message I promised at the beginning: When the police officer showed up, looked over the scene, and heard my description of what happened, he said, "I wish people wouldn't do that." Do what? Well, he said, the drivers in those backed-up lanes thought they were just being nice creating an opening to let that other car through. But doing so creates intrinsically unsafe situations, my wreck being exhibit No. 1 for his point. So my take-away (after watching the tow truck take away my Trooper) is that being "nice" is not always the nice thing to do. People could get hurt and that's not nice at all.

* * *

A hundred years ago, Archduke Franz Ferdinand of Austria, heir apparent to the throne of the Austro-Hungarian Empire, was assassinated by Gavrilo Princip, a member of a secret Serbian military society with grievances against the empire. It's often said that the assassination caused World War I. That's an overstatement; the murder didn't "cause" the war, but it certainly was a key episode in a cascading series of incidents and circumstances that led to the war.

So horrific did that war turn out to be — nearly 20 million people, civilian and military, died during its four years — that diplomats, academics, and intellectuals were convinced that mankind had learned its lesson: In an age of mechanized mass killing, never again would rational people see war as a solution to international problems. World War I was thus "the War to End All Wars."

In a famous debate at the Oxford Union in England in 1933, the motion, "that this House will in no circumstances fight for its King and Country," carried by 275 votes to 153. These very smart people, by an almost 2-1 margin, said "no" to war. But, as Leon Trotsky once said, "You may not be interested in war, but war is interested in you," including not least those idealistic young debaters at the Oxford Union. Six too-short years after that resolution, many of those involved in the Oxford debate had again donned uniforms or in some other way joined the war effort. It turned out there *were* circumstances under which they would fight for king and country after all, this time against Nazi Germany, a perversion of a state that was at war with all that was good and noble and true.

This time, 60 million or more were killed.

But then something happened. First the US and then Russia and several other nations developed nuclear weapons, and now rational people really did understand that there would be no winners in an all-out war. In the 70 years since the end of World War II, there have continued to be wars, too many, and still too much death, but the all-out, unlimited global cataclysm? We've been able to avoid that, thanks, I deeply believe, to our nuclear deterrent and thanks too, to what we've done at Sandia to keep that deterrent viable for 70 years.

See you next time.

Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Craig Smith named Distinguished Fellow by licensing society

Sandia licensing and business development specialist Craig Smith (8539) has been selected as a distinguished fellow by the Licensing Executives Society International (LESI) and its Chemicals, Energy, Environment and Materials (CEEM) sector.

CRAIG SMITH

The society is the world's largest association for the licensing and intellectual property industry. Official announcement of this year's inaugural CEEM distinguished fellows was made at the society's 2014 Global Conference in Moscow.

"Being selected as a CEEM distinguished fellow is a great honor, and this recognition truly means so much to me," Craig says. "I am humbled to be in the company of other great intellectual property mentors and leaders. My selection is also a clear indication that licensing and commercialization efforts at the national lab level are beginning to receive the industry standard recognition they deserve."

Craig develops key commercialization strategies for Sandia's California site, specializing in energy research, cybersecurity, and information technologies. He leads business development and licensing for commercial and open source software at Sandia and has led software development programs for the Consortium for Advanced Simulation of Light Water Reactors and Department of Homeland Security Cyber Division Transition-to-Practice initiative (see story on page 3).

The first LESI Fellows Program launched by the CEEM sector recognizes the professional contributions made by senior members who have volunteered their time throughout the years in support of the intellectual property profession.

Lab News Reader Service

The *Sandia Lab News* is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

Retirees (only): To notify of changes in address, contact Benefits Dept. 3332, Customer Service, at 505-844-4237, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM 87185-1021.

Web users: The *Lab News* is on the external web at www.sandia.gov/LabNews. *Lab News Interactive*, accessible on the internal web, is at: www-irn.sandia.gov/newscenter/interactive.

Sandia LabNews

Sandia National Laboratories

Sandia National Laboratories

http://www.sandia.gov/LabNews

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

Bill Murphy, Editor **505/845-0845**
Randy Montoya, Photographer **505/844-5605**
Mike Janes, California site contact **925/294-2447**
Michael Lanigan, Production **505/844-2297**

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Patti Koning (925-294-4911), Stephanie Holinka (284-9227), Darrick Hurst (844-8009), Stephanie Hobby (844-0948), Heather Clark (844-3511), Sue Holmes (844-6362), Nancy Salem (844-2739), Tim Deshler (844-2502), Mario Alba (284-5768), Valerie Larkin (284-7879), Valerie Smith, manager (844-6167)

Lab News fax **505/844-0645**
Classified ads **505/844-4902**

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468

LOCKHEED MARTIN

Your benefits

Save time and money with your Sandia vision plan

Are you getting the most out of your vision plan? HBE has three simple options you can select to maximize your vision benefits while saving time and money.

1. Get same day appointments and glasses at Vision Works

At Vision Works, a sister company of Davis Vision, you can avoid waiting for appointments and then waiting again to get your glasses. Vision Works offers same-day eye exam with an in-store optometrist and same-day frames and lenses for single vision lenses. Vision Works has more than 2,000 frames to choose from, including designer frames by Michael Kors, Guess, and Vera Bradley, and you can also pick out a second pair of glasses at 50 percent off when you use your vision benefits to purchase your glasses. In addition, the store offers lifetime cleaning and adjustments for your Vision Works glasses. Learn more at http://www.visionworks.com/.

2. Get quicker service with the provider of your choice

Davis Vision offers a special Davis Vision Collection of more than 200 frames at many local providers. When you select a frame from this collection, you could receive your glasses back in almost half the time it would take your provider to turn around a non-collection frame. In 2013, Sandians who chose a Davis Vision Collection frame with a single vision lens had an average turnaround time of three business days. If your provider does not carry the full collection in store, you can also view all of your options on the Davis Vision website. Simply take note of the model number and color from the website and request that your provider order this specific frame for you.

3. Save time and money with mail-order contacts

Davis Vision offers a mail order contact lens replacement program that can save you time and money. By using Lens123 you can save an average of 10 percent or more on your contacts and avoid an unnecessary trip to your eye doctor's office. Lens123 carries a variety of brands, including Acuvue, Proclear, Bausch and Lomb, and Air Optix. Contacts usually ship within 1 to 2 days of ordering.

Learn more about your vision benefits at hbe.sandia.gov.

Sandia cyber portfolio increasing impact through DHS Transition to Practice program

By Mike Janes

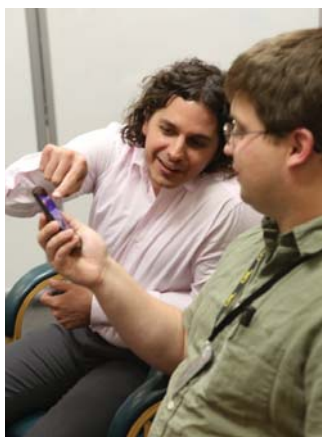
Through the Department of Homeland Security's Transition to Practice (TTP) program, Sandia's cybersecurity technologies — and those of the other DOE labs — now stand a better chance than ever of finding their way into the real world.

DHS's TTP, spearheaded by the department's Science and Technology Directorate, is an innovative program specifically created to assist in moving federally funded cybersecurity technologies into broader use. Getting technologies and research discoveries over the so-called "valley of death" — the wide area that lives between early, promising research on one side and technology that's actually being implemented on the other — is something that Steve Hurd (8958) readily admits is a dire need in the national lab community.

"Moving technologies from the laboratory into actual practice is difficult," Steve says. One of the main reasons, he says, is that technologies that seem to work in the lab may need fine-tuning or further upgrades to work in the field.

"So TTP is an inventive attempt to help all the labs improve in this area," Steve continues. "It's paying dividends already by opening doors that will get new innovative cyber defense technologies from Sandia and other laboratories into the hands of industry, academia, and other research institutions that can really use them."

TTP's methodology is straightforward. DHS's Mike Pozmantier, the program manager for TTP in the department's Cyber Security Division, conducts events across the country each year that feature cyber technologies developed at DOE and DoD laboratories and selected for evaluation by DHS. The events are targeted to specific sectors and audiences; one, for instance, has been held in Washington, D.C., for potential users in the federal government, while another was held in northern California's Silicon Valley for high-tech audiences. Other events target users in critical infrastructure, including an event last year in New York for the financial sector and another this year in Houston focused on energy.



MIKE POZMANTIER with John Floren (8961), who developed a stripped-down Android cellphone known as Hellaphone. The device is a secure smartphone option that features texting, phone calls, a web browser, and other basic features.
(Photo by Dino Vournas)

The goal is to create buzz, generate interest, initiate conversations, and enable relationship-building that will forge business partnerships and ultimately put important cyber technologies, including some developed at Sandia, into practice. That could be accomplished through pilot programs with industry, licensing, or spinning off of technologies into startup companies through venture capital funding, but the first order of business is to identify, test, and evaluate the usability and overall viability of the technologies.

Sandia serving key testing and evaluation role

In addition to considering Sandia-developed cyber technologies for transition, DHS is leveraging Sandia's cybersecurity expertise to test and evaluate (T&E) TTP technologies developed by other DOE and DoD labs. Steve is leading the effort, with key contributions coming from centers 8900, 5600, and 9000.

"Our main goal is to help make the technologies easier and more cost-effective for end users to adopt, ultimately leading to more effective protection of digital systems," says Steve. "We try to discover the areas in the technology that need improvement, then provide specific feedback to the developers."

The team does this, he says, by testing in realistic environments and using a wide range of tools, including dynamic testing of executable files in software and the adversarial-based red-teaming that Sandia has excelled at for years. ("Red teaming" refers to assessments that help customers acquire an independent, objective view of their weaknesses from a range of adversaries' perspectives.)

Sandia is employing two unique capabilities as part of the TTP test and evaluation effort, says Susanna Gordon (8966), Sandia's TTP project manager.

SANDIA'S DANIEL SOH, right, offers an overview of the continuous variable quantum key distribution (CV-QKD) laboratory for the Department of Homeland Security's Mike Pozmantier (center, white shirt). Pozmantier, program manager for DHS's Transition to Practice program in the department's Cyber Security Division, visited Sandia/California recently to observe various cybersecurity projects at the lab and discuss Sandia's test and evaluation role in TTP.
(Photo by Dino Vournas)

"FARM, our Forensics Analysis Repository for Malware, provides a large number of analyzed malware samples that we are using to test technologies intended for enhanced malware analysis," says Susanna. For technologies intended to run on enterprise-scale networks, Sandia's researchers are conducting tests using the Labs' Emulytics™ platforms, which are capable of efficiently emulating and analyzing representative enterprise-scale networks, greatly reducing the cost of running at-scale testing.

"An additional benefit to the TTP test and evaluation work is that we've actually learned some things that can improve our own processes here at the Labs," Steve adds. "We now realize that we need to start at the very beginning when looking at the commercial feasibility of technologies — including those developed at Sandia.

"Though it might seem obvious, we've learned that even the simple question of whether a cyber invention works or can be easily installed by an end user needs to be evaluated," Steve says. "Someone who is developing a technology should be able to hand it to a smart technical colleague with the assurance that he or she will be able to easily and efficiently set it up and use it. If the program is too complicated or complex for that to occur, then it's probably a non-starter. That's a lesson for Sandia as well as the other labs involved in the TTP initiative."

The test and evaluation team also examines the cost of implementation and whether there are new problems or risks associated with each technology it evaluates.

"Maybe the product successfully addresses some problem. But, to use an analogy, Sandia knows from experience that adding new computer security is not like building another fence," Susanna says. "What is intended to add additional security to a computer can actually be counterproductive and break the existing security system. Those things have to be considered very carefully."

Long-lasting value

In TTP's kickoff year, three cyber technologies were selected from Oak Ridge, two came out of Pacific Northwest National Laboratory, and one each was selected from Sandia, Lawrence Livermore, and Los Alamos labs. This past year, when TTP expanded its reach to DoD labs as well as the DOE labs, two Sandia technologies were selected.

"The TTP initiative is really helping Sandia get its cyber technologies to those organizations that need them to better protect their assets," says Steve.

"And we also see it as a way to leverage our testing and evaluation capability, since we truly believe no one else is as good at this particular job," he continues. "It's somewhat under-the-radar and not very visible, and it has been a learning experience to apply our processes to developmental rather than operational technologies. But many of these cyber technologies around the national lab complex will be stronger and more mature due to our test and evaluation support. Ours is a vital role."

The hope, Steve says, is that Sandia's value becomes so clear and recognized by other national labs that they'll begin to approach us, independent of the TTP program, and ask us to provide test and evaluation services. Though that will likely be a challenge due to natural rivalries or perhaps even distrust from other organizations, he and others at Sandia are confident it can happen.

"We go to great lengths to avoid conflicts of interest. We offer an unbiased, third-party assessment of technologies, and we do so in way that incorporates both technical skill and an objective, fair mind-set," says Steve.

To further avoid conflict-of-interest issues, says Steve, Sandia intends to have other independent parties conduct testing and evaluation of Sandia-developed technologies while still employing the same approach and methodology being used throughout the program. For instance, Exelis, a technology company that provides mission-critical, next-generation solutions for the command, control, communications, computers, intelligence, surveillance, and reconnaissance markets, led the T&E activities around Sandia's CodeSeal software.

A third party would also likely be used in cases where Sandia is faced with evaluating a technology that competes directly with one of its own.

"As an FFRDC [Federally Funded Research and Development Center], our main objective is to partner with DHS to improve the nation's cyber security posture in whatever capacity we can best serve," Steve says. "We know that any good cyber technology will benefit the entire community, no matter which lab has developed it, and we are pleased to draw on Sandia's broad and deep cybersecurity expertise to develop new technologies and also to make those of the entire community stronger."

Sandia CaliforniaNews

Early successes offer optimism

The TTP program is only in its second year, but several promising projects have already emerged.

An Oak Ridge National Laboratory cyber system known as Hyperion, selected through the TTP process last year, is designed to compute the behavior of software as a means to gain understanding of software functionality and security properties. Largely as a result of TTP, Oak Ridge is now collaborating with the Defense Intelligence Agency and the US Computer Emergency Readiness Team (US-CERT) on evaluation and deployment of Hyperion.

Sandia's own CodeSeal, also a year-one TTP-selected technology, is a program that protects critical software from malware and a variety of security gaps. CodeSeal is gaining industry traction itself with Vir2us, a Bay Area computer security company, and may soon be piloted in a real-world use case scenario at the DOE GridSTAR Center in Philadelphia. The plan, says Craig Smith (8539), is to bring CodeSeal to GridSTAR — embedded into Vir2us's security suite program, Citadel — to execute on the grid, an activity expected to lead to useful validation data for CodeSeal.

"With successful validation of CodeSeal, we see the opportunity to integrate CodeSeal into Citadel, enhancing Vir2us's already-impressive lineup of security systems," says Craig, who was recently named a Distinguished Fellow of the Licensing Executives Society International (see story on page 2).

Sandia and Vir2us, he says, will then work toward turning CodeSeal into a product as an embedded security solution.

Research Quality Standards case studies

What type is your prototype?

Note: Sandia recently published a new* Research Quality Standards *document that, rather than providing a step-by-step set of requirements, focuses on case studies to define best practices in the world of research. Here is one case study drawn from the 50 in the document. From time to time the* Lab News *will publish others.

* * *

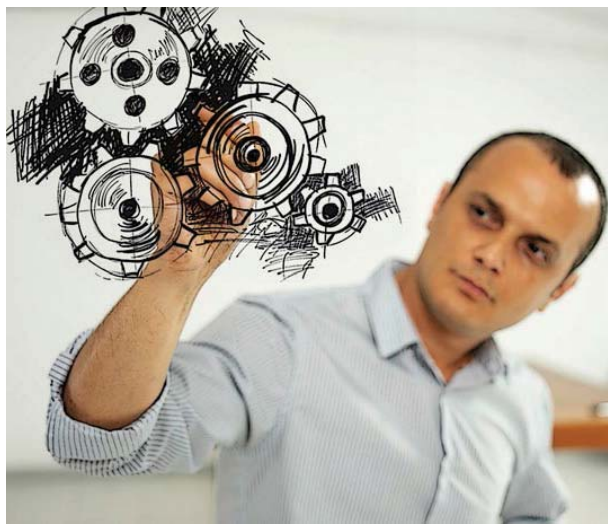
A team from a major US manufacturer was visiting Sandia to investigate the possibility of using Sandia technology in a new product needed for the manufacturer to meet upcoming regulatory requirements. Because these were product-oriented customers who wanted to get to a useful product as soon as possible, the Sandia research manager knew the issue of prototypes and their delivery would have to be addressed quickly. This manager had learned (the hard way) that there are many different pedigrees of prototypes and that to deliver the wrong type of prototype could end the relationship. To address this failure mode, the manager had developed a scale describing typical types of prototypes their customers found value in (in different business situations) and had written the scale down on a single viewgraph to help engage potential customers in discussions to clarify expectations and prevent misunderstandings.

The scale described five different "types of prototypes."

1. Research Demo — Experiment on a lab bench: come into our lab, we will demonstrate it for you

2. Research Prototype — Looks like a product, hand built by PhDs, breaks a lot

3. Engineering Prototype — Research Prototype that is rugged and repeatable



4. Flight or Field Prototype — Engineering Prototype that is reliable and manufacturable

5. Production Prototype — Flight or Field Prototype that has cost "wrung out" (if applicable) and has completed qualification

As the manager reviewed the scale with the visiting team, he read the definition of Research Prototype, "Looks like a product, hand-built by PhDs, breaks a lot." The visiting team roared with laughter. When the laughter quieted down the manager asked the visitors why that was so funny. They replied, "That happens to us all the time." The manager responded, "That is exactly the reason we have this scale. In the past we had some disappointed customers because we delivered the wrong type of prototype. The fact is, we have customers in different business situations and each of these five prototypes is optimal for different business situations. The failure mode that used to occur is that we would think a customer was asking for one type of prototype but they were really expecting a different one. Today, we use this scale to make sure we don't do that to you."

This five minutes of dialog, precipitated by the use of a simple prototype scale, did more to move the trust level with these visitors to a high level than a full day of technology briefings would have and quickly resulted in funded projects.

Moral of the story

"The failure mode that used to occur is that we would think a customer was asking for one type of prototype but they were really expecting a different one."

When you agree to deliver a prototype be aware that there are many different types and it is easy to work hard, deliver the prototype, and greatly disappoint the customer if you don't have a way to clarify and manage the customer's expectations on this. Use a one page "prototype scale" to facilitate dialog with potential customers and get clarification on what type of prototype best meets their needs.

Nanostructures

(Continued from page 1)

fabrication method" that, when applied to nanoparticle arrays, forms new nanostructures with tunable properties.

"There is a great potential market for this technology," he says. "It can be readily and directly integrated into current industrial manufacturing lines without creating new expensive and specialized equipment."

Says Sandia co-author Paul Clem (1816), "This is a foundational method that should enable a variety of devices, including flexible electronics such as antennas, chemical sensors, and strain detectors." It also would produce transparent electrodes for solar cells and organic light-emitting diodes, Paul says.

The method was inspired by industrial embossing processes in which a patterned mask is applied with high external pressure to create patterns in the substrate, Hongyou says. "In our technology, two diamond anvils were used to sandwich nanoparticulate thin films. This external stress manually induced transitions in the film that synthesized new materials," he says.

The pressure, delivered by two diamond plates tightened by four screws to any controlled setting, creates silver nanospheres of any desired volume. Propinquity creates conditions that produce nanorods, nanowires, and nanosheets at chosen thicknesses and lengths rather than the one-size-fits-all output of a chemical process, with no environmentally harmful residues.

Starting to work with nanostructures

While experiments reported in the paper were performed with silver — the most desirable metal because it is the most conductive, stable, and optically interesting and becomes transparent at certain pressures — the method also has been shown to work with gold, platinum, and other metallic nanoparticles.

Paul says the researchers are now starting to work with semiconductors.

Bill Hammetter (1815), manager of Sandia's Advanced Materials Laboratory, says, "Hongyou has discovered a way to build one structure into another structure — a capability we don't have now at the nanolevel. Eight or nine gigapascal — the amount of pressure at which phase change and new materials occur — are not difficult to reach. Any industry that has embossing equipment could lay a film of silver on a piece of paper, build a conductive pattern, then remove the extraneous material and be left with the pattern: a coating of nanoparticles that can build into another structure certain functionality we don't have right now. It's a discovery that hasn't been commercialized, but could be done today with the same equipment used by anyone who makes credit cards."

The method can be used to configure new types of materials. For example, under pressure, the dimensions of ordered three-dimensional nanoparticle arrays shrink. By fabricating a structure in which the sandwiching walls permanently provide that pressure, the nanoparticle array will remain at a constant state, able to transmit light and electricity with specific characteristics. This pressure-regulated fine-tuning of particle separation enables controlled investigation of distance-dependent optical and electrical phenomena.

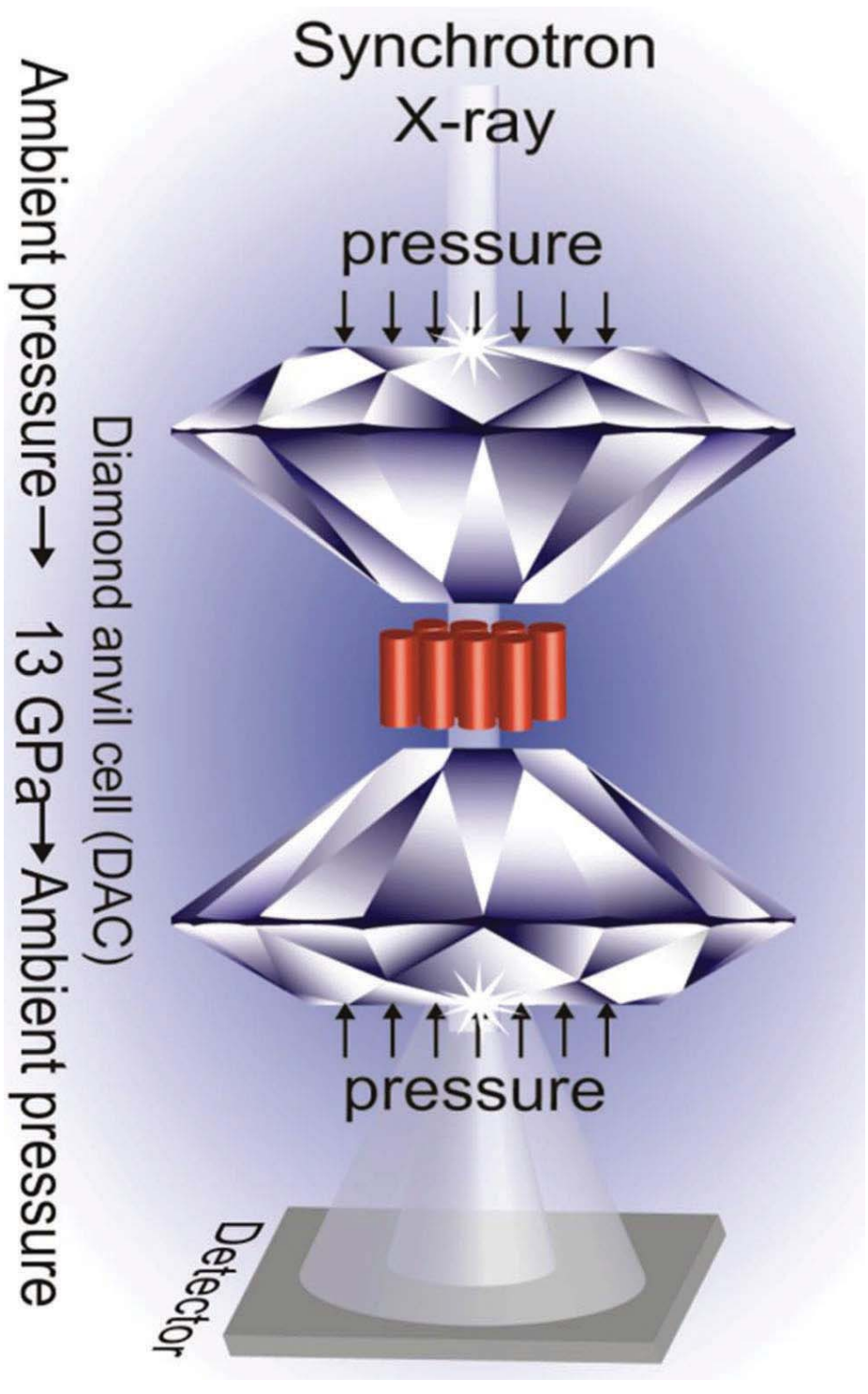
At even higher pressures, nanoparticles are forced to sinter, or bond, forming new classes of chemically and mechanically stable nanostructures that no longer need restraining surfaces. These cannot be manufactured using current chemical methods.

Depending on the size, composition, and phase orientation of the initial nanoparticle arrays, a variety of nanostructures or nanocomposites and 3-D interconnected networks are achievable.

The stress-induced synthesis processes are simple and clean. No thermal processing or further purification is needed to remove reaction byproducts.

This work was funded by DOE's Office of Science. Other authors of the paper are from Cornell University and Los Alamos National Laboratory.

The paper is titled "Stress-induced phase transformation and optical coupling of silver nanoparticle superlattices into mechanically stable nanowires."



PRESSURE, NOT CHEMISTRY — in this illustration, the result of 13 gigapascals of pressure exerted by a diamond anvil on nanoparticles (red cylinders) are examined by X-rays as the process proceeds. Not only are nanowires or other nanoshapes produced from nanoparticles by this method, but, by substituting a suitable substrate for one of the diamonds, the resultant nanowires can be embossed on that surface in a one-step process with little cleanup or waste.

Engineer scores with soccer science book

The Science of Soccer for young readers published in time for World Cup

By Valerie Larkin

If you follow soccer, you've probably heard the term "Messi magic." That's how fans and writers describe some of the impossible things Argentine superstar Lionel Messi is able to accomplish with a soccer ball.

But when Messi curls a ball into a goal from a corner, there's more than magic at work; there's a lot of science at play on the playing field.

In his latest book, *The Science of Soccer: A Bouncing Ball and a Banana Kick,* Sandia retiree John Taylor explores the myriad scientific concepts you'll see on display during a soccer match . . . *if* you know how to recognize them.

Soccer as scientific panorama

"Soccer is more than just a fascinating mobile chess match," the former referee and Stanford University soccer captain writes. "It is also an endless scientific panorama."

Published by the University of New Mexico Press, John's book is written for middle and high school students interested in such scientific aspects of soccer as physics, kinesiology, biomechanics, biochemistry, and fluid mechanics.

The book describes soccer's history, including the recent development of soccer science, and then delves into two key elements of a match: the way the players interact with the ball through kicks, headers, and tactical maneuvers; and the way the ball behaves on the pitch and in the air.

Pressure, elasticity, compression, velocity, and the coefficient of restitution are introduced to explain how a ball rolls and bounces along the pitch. John also describes how energy, momentum, mass, center of mass, friction, torque, and fluid flow allow a ball to fly through the air after a kick.

John explains, for example, the science behind the popular "bend it like Beckham" phenomenon: "If a player hits the ball on one side or the other, he or she can induce sidespin. Using sidespin, the Magnus effect — the combination of differential pressure and momentum transfer that causes an object to curve in flight — will cause a ball to bend around a wall." This ability to "bend" the ball's flight becomes important when a player needs to angle the ball around other players and into the goal.

Appendices offer the calculations behind scenarios discussed in the text such as the trajectory and height of a punt, the time and curvature of a free kick, and even the calories a player burns by sprinting toward a ball.

The book features several experiments John devised for readers who want to see concepts such as viscosity, air flow patterns, and spin in action. Developing the experiments was especially enjoyable, John says. He envisions students conducting the experiments in classrooms and science fairs because they require so few materials.

Writing *The Science of Soccer*

The Science of Soccer is John's seventh book, and he has two more in progress. He has written primarily about New Mexico history, so publishing a title for a young adult audience was a new challenge.

"I had to figure out how to explain something that usually involves a fair amount of calculus to make it more straightforward to the audience I was trying to appeal to," he says.

Students and faculty at the Bosque School in Albuquerque's North Valley reviewed the manuscript and experiments for readability and age appropriateness. Photographs of Bosque School students playing soccer illustrate the concepts discussed in the text.

"It's very satisfying to have an idea and then to put it into words. And one of the things that's great about this," he says, pointing to a stack of his earlier books, "is you get to talk to a lot of people about what you've written." John recently held a book signing for *The Science of Soccer* and is offering a soccer science class for seniors at OASIS Institute Albuquerque in August. The book has been nominated for two 2014 New Mexico Book Awards.

SIGN HIM UP! — Sandia retiree and author John Taylor has some fun at his home in Peralta. He predicts either Brazil or Germany will win this year's World Cup, although he had hoped for a Costa Rica victory. (Photo by Randy Montoya)

Before his retirement in 2010, John worked at Sandia for 35 years as an engineer and department manager. His work included evaluating the transportation of radioactive material, plutonium dispersal analysis, and treaty evaluation and nonproliferation systems analysis. He is currently consulting for the Weapons Intern Program and updating the National Security Display Gallery. He has written two books on the Civil War in New Mexico, two on Catholicism in central New Mexico, and one collection of anecdotes about murders and mysteries in Valencia County.

TELL US HOW YOU REALLY FEEL — Sandia retiree and author John Taylor talks with passion about one of his favorite subjects: soccer. John has written *The Science of Soccer* to explain some of the science behind the action you see on the field. (Photo by Randy Montoya)

Soccer science on display in 2014 World Cup

Science has been a popular theme during the 2014 FIFA World Cup. Goal-line technology was introduced, a mind-controlled robotic suit allowed a paraplegic fan to deliver the tournament's opening kick, and headlines have touted the Brazuca, the official match ball, as one of the most aerodynamic soccer balls ever created.

With only six thermally bonded — not stitched — polyurethane panels, the Brazuca represents how far the soccer ball has come since the game's early days. "Some ancient ball games were played with balls that were animal skins stuffed with hay or sand. There are also stories of games played with the heads of defeated enemies! These games must have been a bit slow-paced, since some of the most intriguing aspects of the game occur because the ball bounces," John writes.

World Cup boosts soccer in US

"Soccer is a game of tactics and strategy with a rich overlay of history and tradition. It is, without question, the most popular sport in the world. In fact, the quadrennial World Cup tournament is the world's most-watched event," John writes.

Although professional soccer has yet to experience the sustained popularity of football or basketball in the US, it has already experienced a boost with the national team performing well on the international stage. "If you look at the Ghana game, it was significant," John says.

This year's tournament has broken television audience records in the US. When the US and Ghana played on June 16, it was the most-watched soccer match in US history. That record was broken the following week, however, when the US and Portugal tied on June 22. On July 1 when the US lost to Belgium, ratings showed the broadcast had drawn the second-highest US television audience for a men's game.

Sandia transfers management for production of four component families to Kansas City Plant

By Sue Major Holmes

Sandia has transferred management authority for the production of four nuclear weapon product families to the Kansas City Plant. NNSA agreed with Sandia's suggested move to better align production responsibilities to each site's core competencies.

Sandia President and Laboratories Director Paul Hommert and Chris Gentile, president of Kansas City Plant contractor Honeywell Federal Manufacturing & Technologies, signed the agreement June 24 at the National Security Campus in Kansas City, launching a one-year transition period. Sandia transferred production authority to Kansas City for four devices and assemblies.

Better alignment with core strengths

"This is a self-started and collaborative initiative we have developed together and fully endorse," Paul said. "We believe it better aligns core strengths at each site and that it creates added value and efficiencies through the consolidation of resources and the leverage of existing supply chain management systems and infrastructure."

The shift in workload represents about $100 million over 10 years, running through fiscal year 2024, said Org. 2500 Director Anthony Medina, who is in charge of Sandia's External Production Program.

During the transition, Sandia will familiarize KCP with requirements for each product — about 50 individual parts in all — and the operation of the testers that collect data to make sure those requirements are met, said Org. 2600 Director David Plummer, whose organization is responsible for three of the four transferred product families and who attended the ceremony along with Paul and Geoffrey Beausoleil, manager of the NNSA Sandia Field Office.

Sandia retains design authority for those components. It also will continue managing external production for four other families of products whose production needs better align to Sandia capabilities.

KANSAS CITY WORK — Sandia President and Laboratories Director Paul Hommert, left, and Geoffrey Beausoleil, manager of the NNSA Sandia Field Office, discuss the complexities of a weapon assembly with expert welder Tim Ward during their tour of the National Security Campus at Kansas City on June 24. (Photo courtesy of the Kansas City Plant)

Intern Technology and Business Expo

Photo by Randy Montoya

Sandia's summer interns gathered recently in Bldg. 858EL for the day-long Intern Technology and Business Expo, which provided a one-stop opportunity for interns to learn about career options at Sandia with select managers and staff representing Sandia's top hire fields.

Areas of focus during morning sessions included a computer science/computer engineering track and a mechanical engineering track.

After a lunch break, afternoon tracks included an electrical engineering track, a business track, and a materials science and engineering track.

In the photo below, Basil Hassan, manager of Aerospace Systems Analysis Dept. 5422, addresses interns during the morning track on mechanical engineering opportunities at Sandia.

The event was hosted by Recruiting and Student Programs Dept. 3555. For more information about intern programs and activities, go to http://info.sandia.gov/interncentral.

Record number of Sandians considered for prestigious HENAAC awards

HISPANIC ROLE MODELS — Fourteen Sandians were recommended by their managers for Hispanic Engineer National Achievement Awards (HENAAC), and two of them were selected to be the Labs' official nominees. The awards program, now in its 26th year, honors the nation's best and brightest Hispanic engineering, science, and technology experts. Nominees from around the country will be evaluated by Great Minds in STEM, which coordinates the annual HENAAC awards and conference. The call for nominations within Sandia brought a record number of potential nominees. They were recognized at a June 19 event. Among them, in the photo above, were (back row from left) Julie Cordero (4879), Dena Vigil (1441), Lysle Serna (1818), and Marie Arrieta (6813), and (front row from left) Richard Flores (1767), Larry Carrillo (8247), Oscar Hernandez (5952), and Edward Jimenez Jr. (9515). Not pictured are Reno Sanchez (5771), Igal Brener (1712), Kristina Rodriguez Czuchlewski (5346), Rudy Garcia (5554), Patrick Sena (2220), and Steven Trujillo (1220). Julie and Edward were chosen to move forward in the awards program. Thirty Sandians have received HENAAC awards in the past 17 years. Anthony Medina, Center 2500 director and a HENAAC winner, said at the event that the internal nominations "identify and lift up role models in the Hispanic community to inspire young people to take up STEM fields in school." (Photo by Randy Montoya)

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads

MISCELLANEOUS

FABULOUS FELINES SUMMER PARTY, Sunday, July 13, food, music, silent auction, call for more details. Mundt, 505-412-3812, ask for Miranda.

ELLIPTICAL, Sole E55, w/many features, excellent condition, $600. Tafoya, 264-7510.

ABOVE GROUND POOL, Intex, 18' x 48", clean, good condition, w/pump, hoses, many accessories, $200 OBO. Walker,505-379-9745.

TIMESHARE, Winter Park, CO, July 25-Aug. 1, $600. Buck, 353-2667.

PRECIOUS MOMENTS Southern Bell Tiffany doll, 16-in. tall, w/tags, excellent condition, photos available, $15. Baros, 417-9841.

TIMESHARE, Sheraton Desert Oasis, wk. 14, biannual, odd years, 2-bdr., $1 plus closing cost. Begay, 259-3253.

FAMILY CLOTHING SWAP MEET, Aug. 2, 8 a.m.-noon, 11515 Lomas NE, in need of gently used clothing for all ages. Baca, 974-0740, ask for Pat.

SPARE TIRE, new, BF Goodrich Mud Terrain, 33x12.5R15, KM2, w/black Jeep rim, $250 OBO. Hernandez, 505-417-0695.

FOUR-POSTER CANOPY BED, queen, $600; sectional sofa, dual recliner, $200; futon, $60; Quadcopter battery charger, $60; Spektrum DX7 remote control, $90. Mackoy, 550-0674, rd.mackoy@q.com.

CARGO/LUGGAGE TRAILER, small, titled & registered, $675; 5-1/2' x 10' trailer, single axle, titled & registered, $1,095 or $1,500/both. Willmas, 505-281-9124, evenings.

PATIO FURNITURE SET, large, 40" x 72" stone table, 6 armed chairs, all aluminum construction, $375 OBO. Hietala, 610-1252.

DINING ROOM SET, wood veneer, 4 chairs, 59" x 41", 18-in. leaves, $225; Sportcraft pool table w/ping pong board & net, balls, cue sticks, $180. Norwood, 331-8608.

POOL TABLE, Connelley Ventana, maple, 8-ft., w/light fixture, sticks, décor, perfect condition, $1,000. McLeod, 855-9449.

WOOD DINING TABLE, w/6 chairs, cloth seats, good condition, $125 OBO. Romero, 307-9389.

DINING TABLE, slate inlay, 4 chairs, baker's rack, $500; wood futon, thick mattress, $300; excellent condition. Miller, 303-868-2227.

RUIDOSO TIMESHARE, 2-bdr., Crown Point Condominiums, $1,680 includes title transfer fees/annual fee of $528. Tapia, 505-331-8878, ask for Carolyn.

ANNUAL GOLF TOURNAMENT, Friday, Aug. 1, 8 a.m. shotgun, UNM Championship Golf Course, proceeds benefit Legacy Academy students. Mondragon, 923-3659.

JUNIORS WOMEN'S CLOTHING, sizes XS-M, Bebe, Guess, etc., purses, heels/pumps, size 6 & 6.5, new. Velasquez, 610-3672.

BED TOPPER, king, memory novaform, 3-in., $80; queen box spring, $100; all barely used. Furry, 505-228-4759.

TWO-SEATER SWING, Pinehurst, dark green, $120. Lewis, 323-7268.

DIGITAL CAMERA, Nikon CoolPix P310, great pocket camera, very good in low light & video, w/accessories. Smith, 244-8346, smithfoto@comcast.net.

TRANSPORTATION

'12 HONDA FIT, base model, manual transmission, 29K miles, $11,500. Urioste, 505-918-4054.

'02 ISUZU RODEO, 4x4, new paint, tires, brakes, shocks, new XM radio, Bluetooth, iPhone sync, remote alarm, clean, 141K miles, $5,250 OBO. Nation, 385-2491.

'84 VOLVO 240 GL, 4-dr., 4-cyl., silver metallic, w/blue velvet interior, AC, 113K miles, great condition, $3,400 negotiable. Garcia, 554-2690, ask for Belinda.

'96 JEEP CHEROKEE, new tires, original engine w/~294K miles, well maintained, runs great. Gianotti, 505-440-0495.

'00 FORD RANGER, super cab, standard, full bed/liner, trailer hitch, 200K miles, excellent condition, $4,100 OBO. Crosby, 260-1070.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on News Center, then on *Lab News* link, and then on the very top of *Lab News* homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.**

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

'10 FORD MUSTANG GT, AT, navigation, leather, new tires, Grabber blue, white stripe, 28K miles, $23,000 OBO. Mathews, 379-1430.

'03 HONDA S2000 CONVERTIBLE, new factory top, 6-spd. manual, 85K miles, great condition, $16,500. Forester, 459-0131.

'13 VW TIGUAN S 4 MOTION, white, climate control, cargo & floor mats, 6.4K miles, clean, $23,176. Brannon, 821-9425.

'97 MERCEDES C230, needs tumbler, 214K miles, looks & runs well, $2,500 OBO. Cochrane, 505-918-5665.

'05 TOYOTA MATRIX, AWD, AT, dark grey, Michelins, great mpg, 146K miles, excellent condition, $5,300. Dwyer, 271-1328.

'57 CHEVY BEL-AIR, 4-dr. sedan, original engine & transmission, easy restoration, very little rust. $7,000 OBO. Olguin, 259-8142.

RECREATION

'04 STARCRAFT POP-UP CAMPER, 12-ft. box, stove, furnace, refrigerator, water heater, outdoor shower, sleeps 8, $4,750. Kincaid, 296-6014.

'04 HARLEY SOFTAIL SPRINGER, w/extras, like new, 15.8K miles, $11,500 firm. Stout, 505-715-2291 or 805-863-2754.

MOUNTAIN BIKE, Felt compulsion LT, new $4,000, asking $1,500. Lehoucq, 821-5306.

'05 KAWASAKI ZX6R 636, bright green, new battery, 15.6K miles, well maintained, $4,600 OBO. Sonntag, 505-350-4694, ask for Tyson.

'12 FOREST RIVER FLAGSTAFF TRAVEL TRAILER, V-Lite, 30WRKSS, 2 slides, 1-1/2 bath, extras, excellent condition, $22,500. Sandoval, 505-792-7883.

'92 PROWLER TRAVEL TRAILER, model 24 C, sleeps 5, fully self-contained, excellent condition, $3,000. Finley, 293-1961.

REAL ESTATE

4-BDR. HOME, 3 baths, ~2,500-sq. ft., large loft, minutes to KAFB, 2828 Porto SW, MLS# 817023. Sandoval, 514-8214.

4-BDR. HOME, Sandia high school district, well maintained, will consider REC, $205,000. Mozley, 884-3453.

3-BDR. HOME, 2 baths, 1,460-sq. ft., tile floors, granite countertops, fully landscaped, Volterra subdivision, minutes from Sandia, $210,000. Bucy, 402-239-6202.

3-BDR. HOME, 2-1/2 baths, 1,600-sq. ft., 2-car garage, quiet Vista Del Norte street, balloon fly-bys, MLS#815674, $190,000. Chavez, 505-750-8276.

2-ACRE LOT, Cedar Crest home site, gorgeous, level, fenced, water, mountain views, not rocky, $105,000, easy terms. Mihalik, 281-1306.

3-BDR HOME, 2 baths, 1,616-sq. ft., Southwestern-style, AC, energy efficient windows, re-stuccoed, Taylor Ranch, MLS#817747. Lojek, 904-814-5432.

4-BDR. HOME, 3-1/2 baths, 2,086-sq. ft., built in 2007, Volterra subdivision, minutes to Sandia, MLS#816122, $250,000. Pena 505-206-2701.

2 ACRES, Richland Heights subdivision, paved roads, water membership included, underground utilities, restrictive covenants, $69,900 OBO. Wolf, 505-934-6753.

3-BDR. HOME, 2 baths, fresh paint, landscaped, auto sprinkler, new wood floors, large lot, in-ground pool, Rio Rancho, owner financing or real estate contract, FSBO. Cordova, 505-400-2792.

3-BDR. HOME, 2 baths, 2-car garage, 1,700-sq. ft., hobby room, sun room, 2 living areas, near Eldorado, great starter, $177,000. Rankin, 505-293-5464.

4-BDR. HOME, 2-1/2 baths, 2,777-sq. ft., formal living & dining, family room, loft, 2-story, enclosed hot tub, back & side yard access, will consider REC, MLS#806686. Maestas, 505-459-7650.

3-BDR. HOME, 2 baths, new listing, Willowwood, next to Tech Park, walk to Sandia, MLS#818862, $270,000. Dinge, 505-818-8933.

WANTED

LANGUAGE CDS, for beginner Italian, used, inexpensive. Green, 898-3791.

ROOMMATE, just outside Eubank gate, washer/dryer, WiFi, cable, must like dogs, $500/mo., utilities included. Keller, 504-4482.

ROOMMATE, near Balloon Park, I-25 & Alameda, furnished room, $450/mo., 1/2 utilities. Ortiz, 505-710-6617.

ROOMMATE, share 3-bdr. home, Unser/Paradise NW, washer/dryer, WiFi, cable, private bath, furnished bdr., $450/utilities included. Garcia, 505-792-0309.

LOST & FOUND

FOUND: 2 small key rings (CA Alumni Assoc. tag), w/14 keys, found on Tuesday, June 24, 4th floor, Bldg. 897, contact to describe & claim. Eppinga, 845-8468, baeppin@sandia.gov.

Recent Retirees

Steve Nowlen
30 6231

Karl Horak
15 6832

Mileposts

New Mexico photos by Michelle Fleming

Rosemary Baca
35 10623

Patrick Manke
35 9335

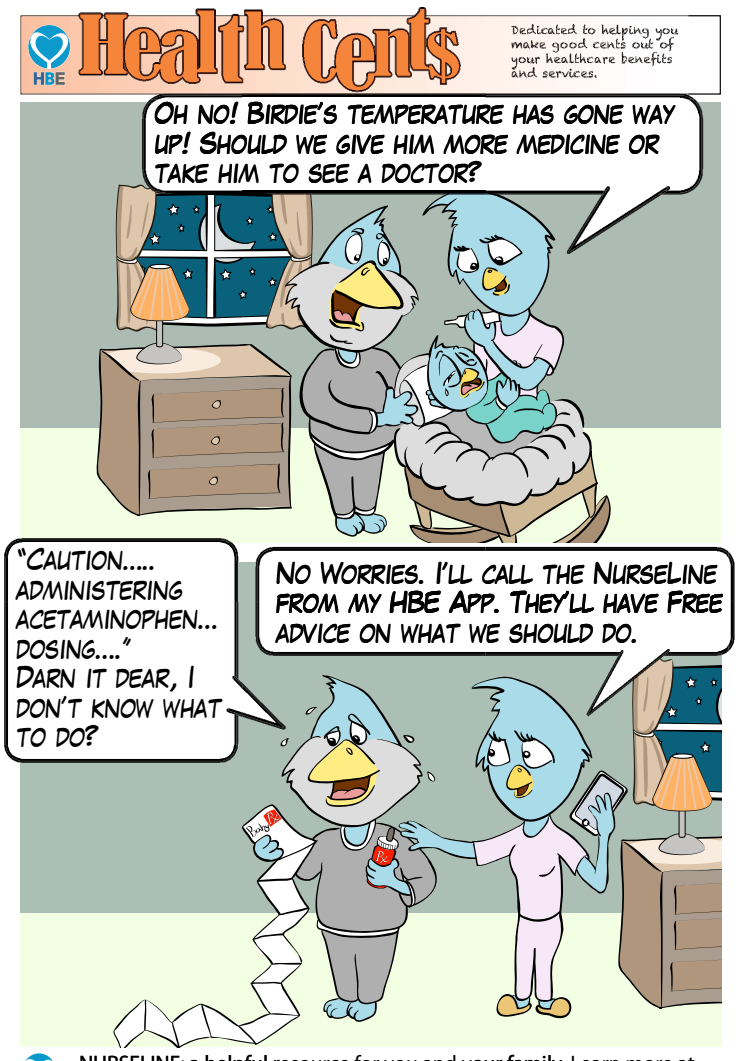
Paul Justice
30 6811

Perry Molley
30 5351

Gary Simmons
25 10261

Elaine Herrera
20 10221

Ken Keahbone
20 9344



HBE **NURSELINE: a helpful** resource for you and **your family.** Learn more at hbe.sandia.gov. **In case of emergency, call 911.**

Randy's 4th

***Lab News* photographer Randy Montoya captures magic, excitement of Independence Day**

Talent to share

Joint hire brings Sandia, UNM more R&D collaboration

By Nancy Salem

Sandia and the University of New Mexico have hired Fernando Garzon, a nationally recognized scientist and inventor, to work for both institutions to advance mutual interests in science and engineering. It is the first joint hire recruited together by Sandia and UNM.

"Sandia National Laboratories and the University of New Mexico have enjoyed a close relationship for many years in the areas of research, education, and technology development and deployment," says Div. 7000 VP and Chief Technology Officer Julia Phillips. "The joint-hire program is a natural development in that deepening partnership and one that promises new opportunities for even stronger collaborations between the two institutions."

Garzon has been technical team leader for high-temperature materials chemistry in the Sensors and Electrochemical Devices Group at Los Alamos National Laboratory. He holds a Bachelor of Science in metallurgy and materials science and a doctorate in material science and engineering from the University of Pennsylvania. He joined LANL in 1988.

Garzon will concurrently hold the positions of R&D staff member at Sandia and tenured professor at UNM. He is considered a part-time employee of each institution with workspace provided by both. He will split his time equally, or 20 hours a week at each institution, and each will offer a separate salary and benefits package based on the part-time work.

FERNANDO GARZON, who joins the staffs of Sandia and the University of New Mexico later this year, has co-authored more than 130 scientific publications with over 4,000 citations. He holds 10 patents in electrochemical technology and has been president of the Electrochemical Society. "The synergies between the university and the national lab create a unique research environment to mutually develop advanced energy technologies," he says.

He will establish and lead a research program in the area of materials science and engineering with an emphasis on energy technologies. According to the join-hire agreement he will initiate and foster research collaborations among UNM faculty and Sandia R&D staff. He will attract, mentor, and direct junior faculty and Sandia researchers, postdocs, and students to both Sandia and UNM. And he will help form strategic partnerships between Sandia, UNM, and other research institutions.

"I am very excited to work with both UNM and Sandia," Garzon says. "The synergies between the university and the national lab create a unique research environment to mutually develop advanced energy technologies."

Sandia and UNM signed a memorandum of understanding in 2011 that identified areas of research collaboration and contemplated the joint hiring of nationally prominent faculty. Two Sandia researchers, Jeff Brinker (1000) and Rick Kemp (1815), also work for UNM as professors, but were Sandia employees before joining the university. Garzon is the first to start as a joint employee.

Terry Aselage, director of Sandia's Materials Science and Engineering Center 1800 and a member of the Sandia search team, praised the process for hiring Garzon. "The engagement from UNM leadership was fantastic, and the search committee members from both sides worked hard and well together," Terry says. "I am certain that these interactions will further the Sandia/UNM collaboration, and that the Advanced Materials Laboratory, which supports collaboration among Sandia, UNM, and industry in materials R&D and tech transfer, will continue to serve as a flagship for these collaborations."

Garzon's research interests include fuel cell materials technology, energy storage, high-temperature materials and devices, development of advanced gas sensors, electronic conducting transition metal oxides, thin film growth, ceramic membrane technology, and solid state ionics. He has co-authored more than 130 scientific publications with more than 4,000 citations. He is an inventor of an R&D 100 award-winning high temperature combustion control sensor. He also developed a new class of solid-state gas sensors for hydrocarbons, carbon monoxide, and nitric oxides.

Garzon, who starts work at Sandia and UNM later this year, holds 10 patents in electrochemical technology. He has been president of the Electrochemical Society and is a Fellow of the organization.

"The cooperative arrangement also creates an outstanding education experience for students and postdoctoral fellows," Garzon says. "I will be actively engaged in energy storage and conversion research programs and the development of sensing technology to meet future needs for energy efficiency, environmental monitoring, and national security."

"As a distinguished, nationally known researcher with experience at a national laboratory and in academia, Dr. Garzon is ideal for serving as the liaison who helps pull together and develop staff from both worlds to tackle important research," Julia says. "His role should be to create new programs that both draw on and benefit research staff and the important missions of both Sandia and UNM."